ABSTRACT OF THE DISCLOSURE

A magnetic resonance imaging system comprises a phased array coil assembly and a signal processing circuit. The phased array coil assembly includes a plurality of coils coextensively covering a predetermined area. Each of the plurality of coils comprises a different number of loops over the predetermined area and divides the predetermined area into at least three contiguous regions arranged linearly along the predetermined area. The signal processing circuit is coupled to the phased array coil assembly for receiving a plurality of magnetic resonance signals detected by the plurality of coils. The signal processing circuit is configured to localize the plurality of magnetic resonance signals originating in at least one of the contiguous regions.